



A Review On Phytochemical Analysis Of Some Medicinal Plants

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Article History	Abstract
<p>Received: 10/08/2023 Revised: 12/9/2023 Accepted: 16/10/2023</p>	<p>Medicinal plants contain phytochemical like alkaloids, flavonoids, phenol, amino acids, protein, carbohydrates, saponin, tannin etc. Alkaloid plays an important role in the medicinal plant. Alkaloids are nitrogenous compound of low molecular weight. Alkaloids have diverse physiological effects: anti-bacterial, anti-mitotic, anti-inflammatory, analgesic, local anesthetic, hypnotic, psychotropic, and anti-cancer activity. Detection of the alkaloid can be done by standard experiments like Mayer's test, Wagner's test, Dragendroff test, Fehling's test and Molish's test for carbohydrate, Ferric chloride test for flavonoids, foam test for saponin, Biuret test and Ninhydrin test for protein, Folin-Ciocalteu test for phenols others are Borntragers Test, Salkowski's Test, Alkaline Reagent Test, Xanthoproteic Test, Ninhydrin Test, and Copper Acetate Test. The main objective intent of this study is to evaluate and review the profitability of determining secondary metabolites in the medicinal plants. Articles issued between the years 2012 to 2022 were encompassed in this review. Databases like PubMed, Google scholar were trouped for assemblage the articles. Key phrase like phytochemical analysis, alkaloid content, Mayer's test, UV-visible spectrophotometer were accustomed for assemblages of articles. On comprehensive evaluation of articles application of Mayer's test to determine alkaloids in various drugs for qualitative analysis and UV-vis spectrophotometer for quantitative work with comparative analysis.</p>
<p>CC License CC-BY-NC-SA 4.0</p>	<p>Keywords- Alkaloid content, Mayer's test, Phytochemical analysis, UV-visible spectroscopy.</p>

INTRODUCTION

The main purpose of this article is to review various phytochemical present in medicinal plant. About 64% of the global population remains dependent on traditional medicines and medicinal plants to provide for their healthcare needs. According to a study by WHO, practitioners are prescribing traditional medicine to about 80% of patients in India. It indicate that the therapeutic use of plants is as old as 4000-5000 BC, and the

Chinese first used natural herbal preparation as medicines. Modern pharmacopeia contains at least 25% of drugs derived from plants and many other synthetic compounds isolated from plants. Since disease, decay, and death have always co-existed with life, early man had to think about disease and its treatment. Thus, the human race started using plants to treat diseases and injuries from the early days of civilization on earth. Its long journey from ancient to modern times has successfully been an effective therapeutic tool for fighting against diseases and various health hazards.

The presence of phytochemical compound in any substance indicates its medicinal potentials. Medicinal plants contain some organic compounds which provide definite physiological action on the human body and these bioactive substances includes alkaloids, carbohydrates, tannins, steroids and flavonoids. The presence of tannins shows anti-parasitic, antiviral and antibacterial activities. Flavonoids have anti-inflammatory, anti allergic, antioxidant, and anticancer activities. Saponins used as adjuvant in vaccines because it acts as antifeedants. Presence of alkaloids shows anticancer, antiarrhythmic, antimicrobial, and analgesic activity. Phenols are antioxidant used as antiseptic and active ingredient in some oral analgesics.

Alkaloids are naturally occurring organic compound that contain nitrogen atom. Alkaloids are mostly basic in the nature but also present in neutral and weakly acidic form. They are produced by plants, animals and microorganisms like bacteria, fungi etc.

The name "alkaloids" (German: Alkaloide) was introduced in 1819 by the German chemist Carl Friedrich Wilhelm Meißner, and is derived from Latin root alkali and any of a class of naturally occurring contains organic nitrogen containing bases. These nitrogen atoms can behave like a base in acid-base reactions. Alkaloids are treated as amines, same as amines in their names, have suffix *-ine*. Alkaloids in pure form are usually colorless, odorless crystalline solids, but sometimes they can be yellowish liquids. Quite often, they have bitter taste. From a structural perception, alkaloids can be classified, based on their molecular precursor, structures, and origins or on the biological pathways used to obtain the molecule.

Alkaloids are divided into five major groups:

- a) True alkaloids- Alkaloids which originates from amino acids and contain nitrogen in the heterocycle.
- b) Proto-alkaloids- Alkaloids which originate from amino acids and contain nitrogen but not the nitrogen heterocycle.
- c) Polyamine alkaloids – derivatives of putrescine, spermine, and spermidine, Peptide and cyclopeptide alkaloids.
- d) Pseudo-alkaloids – These are the alkaloid-like compounds which do not originate from amino acids.

Alkaloids play an essential role in both human medicine and in an organism's natural defense. Alkaloids make up approximately 20% of the known secondary metabolites founds in plants. In plants, alkaloids protect plants from predators and regulate their growth. Therapeutically, alkaloids are particularly well known as anaesthetics, cardioprotective, and anti-inflammatory agents. Well-known alkaloids used in clinical settings include morphine, strychnine, quinine, ephedrine, and nicotine. Recently, there is a resurgence of interest in bioactive natural products, driven both by a very proactive development in the field of traditional medicines (ethnopharmacology) as well as their potential in drug discovery.

Alkaloids have diverse physiological actions: antibacterial, antiviral, antimitotic, anti-inflammatory, antiasthma, vasodilator, analgesic, local anesthetic, hypnotic, psychotropic, and anti-cancer activity. Alkaloids are found in many foods including fruits and vegetables.

Mayer's reagent is an alkaloid precipitating reagent utilized for the detection of alkaloids in natural and medicinal substances. Mayer's reagent is freshly prepared by dissolving a combination of mercuric chloride and potassium iodide in distilled water. Most alkaloids are precipitated from neutral or slightly acidic solution by Mayer's reagent to give a cream color precipitate.

UV-vis spectroscopy is generally used in analytical chemistry for quantitative determination of sample. Spectroscopic analysis is commonly carried out in solutions but gases and solids can also be studied. With UV-Vis spectroscopy, the UV-Vis light is passed through a sample and the transmittance of light by a sample is measured. From the transmittance (T), the absorbance can be calculated as $A = -\log(T)$. An absorbance spectrum is obtained that shows the absorbance of a compound at different wavelengths. The amount of absorbance at any wavelength is due to the chemical structure of the molecule. UV-vis spectroscopy is used to determine the concentration of the absorber in a solution. According to the

concentration of the solution absorbance value will also be change. The peak height for a particular concentration is known as response factor. The wavelengths of absorption peaks are correlated with type of bonds in molecule and also valuable to determining the functional group.

Proposed reaction for Mayer test

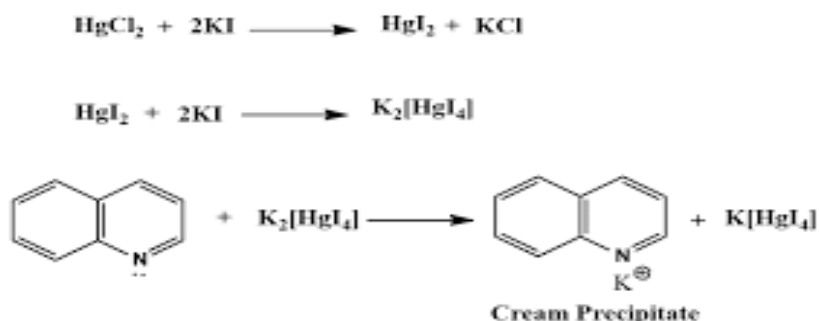


Fig. 1 Proposed reaction for Mayer's test for alkaloids

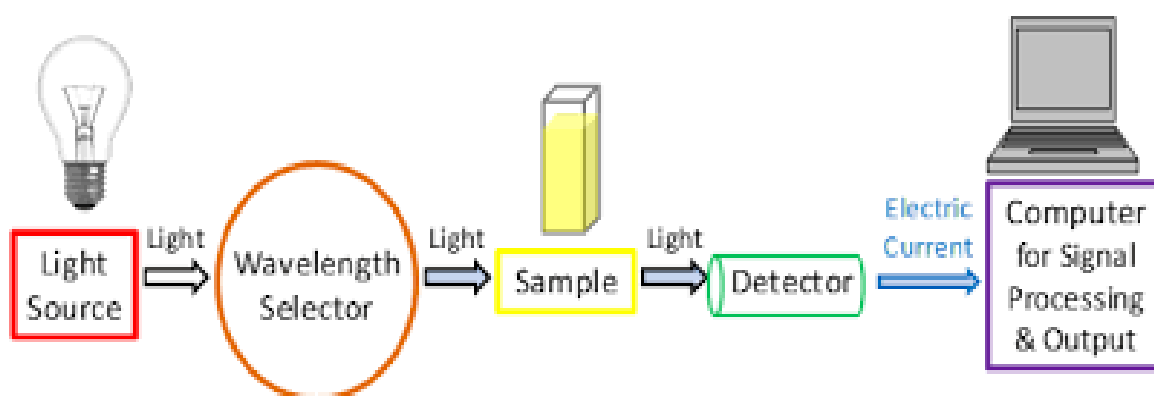


Fig. 2 Principle of UV-visible spectrophotometer

METHODS

Data were collected from various databases such as Scopus, Science Direct, Web of Science, PubMed, Research Gate, and Google Scholar, between the years 2012 to 2022. Data were collected by means of key phrases like; Phytochemical analysis, alkaloid content, Mayer's test, UV-visible spectroscopy.

Rauwolfia serpentine was tested for alkaloids. Presence of alkaloids was confirmed by Mayer's and Wagner's test. Amount of crude alkaloids was found 0.416 mg/g in roots, whereas it was 0.217 mg/g in leaf fraction on dry weight basis. High-performance liquid chromatography analysis showed six spots or fractions were observed from root extract whereas, four from leaf extract of Rauwolfia serpentine. ^[1]

Piperine alkaloids from black pepper seeds were identified by Wagner's test, Mayer's test and its absorption with thin layer chromatography. The results of biological activity study suggest that the ethanol extraction of Piperine alkaloid founded very much effective against *E. coli*, *Staphylococcus aureus*, *Pseudomonas*, *Streptococcus*, *Aeromonas*, *Klebsiella*, *Acinetobacter*. ^[2] The phytochemical test reveal that the flower extracts of *Azadirachta indica* were found to be positive for the presence of phenols, flavonoids by NaOH test, alkaloids by Dragendroff's test, saponin by frothing test, steroidal nucleus by Salkawoskii and cardolinide test, carbohydrate by Molisch's test, reducing sugar by Fehling test and the result was negative for the presence of flavonoids by ferric chloride and lead acetate test, alkaloids by Molisch's test, carbohydrate by Baerfoed's test, phlobatannins and anthraquinones by Bomtragers's test. The seed oil extracts of *Azadirachta indica* were positive for the Phytochemical Analysis & Antioxidant Activity of Flower & Seed Oil Extract of *Azadirachta Indica*. Phytochemical analysis confirmed the presence of phenols, flavanoids by NaOH test, quinoline alkaloids by Thalleiquine test, cardiac glycoside by Salkawoskii and Cardenolide test, carbohydrate by Molisch's test, anthraquinone by Bomtrager's test and the result was negative for the presence of flavonoids by ferric chloride and lead acetate test, alkaloids by Dragendroff's and Mayer's test, saponin by frothing test, carbohydrate by Berfoed's test and reducing sugar by Fehling test. ^[3]

Author	Result
Dmitry Bokov et al, 2018	Galanthus woronowii and Galanthus nivalis homoeopathic mother tincture was prepared by whole flowering plant. Presence of flavonoids and Amaryllidaceae alkaloids confirmed by Wagner's and Dragendorff reagent. The spectral peaks shows the presence of different alkaloids in Galanthus woronowii and Galanthus nivalis homoeopathic mother tincture by electronic absorption spectrum with bend at 400 nm. ^[4]
Ramdoss Karthikeyan et al, 2014	The main bioactive compounds from Berberis vulgaris are alkaloids berberine, berbamine, jatrorrhizine, columbamine, berberubine, oxicanthine, palmatine, vitamin C, resin, and tannins, and flavonoids like quercetin and kaempferol. Berberis vulgaris tincture shows maximum absorption of berberine on the wavelength of 428nm in UV-visible spectrophotometry. ^[5]
Rakhi Mishra et al, 2019	The phytochemical analysis of Holarrhena anti-dysenterica mother tincture using various reagents including mayer's reagent showed presence of secondary metabolites like flavonoid, alkaloid, triterpenoid, steroid, glycosides and saponins. The two peaks were found at 228 nm and 278 nm. ^[6]
Uma maheswari A et al, 2021	Raphanus sativus extract was mixed with mayer's reagent, cream color precipitate indicates the presence of alkaloid. Absorption peak was observed at 369 nm indicated the reduction of metal oxide and synthesis of ZnO nanoparticles from zinc acetate. ^[7]
P. Raji et al, 2019	Cassia alata, Thespesia populnea, Euphorbia hirta and Wrightia tinctoria medicinal plants were tested for the presence of secondary metabolite in it. The UV visible spectroscopic profile of the alkaloid samples recorded peaks at 400 nm and 650 nm. For the flavonoid samples major bands were observed at 250 nm and 360 nm. For the saponins peaks recorded at 390 nm and 620 nm (only for Thespesia populnea). A peak near 250 nm was seen in all the tannin extracts. ^[8]
Lim Seow Li et al, 2020	Erythroxylum cuneatum extract was tested for presence of alkaloid using Mayer's reagent. This was further confirmed with thin layer chromatography. The TLC plates showed 4 spots of alkaloids in the E. cuneatum leaves extract. Tropane alkaloids including -3 α , 6 β -dibenzoyloxytropine act as principal alkaloid in E. cuneatum. The free radicals scavenging activity of E. cuneatum alkaloid leaf extract was evaluated using DPPH reagent, absorbance was read at 517 nm using UV-vis spectrophotometer. ^[9]
K Kalaichelvi et al, 2017	Phytochemical analysis of petroleum ether, acetone, chloroform, ethanol and aqueous extract of whole plant of Micrococca mercurialis revealed the presence of alkaloids, glycosides, flavonoids, phenols, saponins, steroids, amino acids, tannins, terpenoids, quinones, anthraquinones and coumarin. The UV-vis spectrum showed the peaks at 214, 446 and 472 nm with the absorption rate of 0.599, 0.655, and 0.550 respectively. ^[10]
M M Hossain et al, 2022	The phytochemical screening of Ipomoea hederifolia stems extract showed the presence of alkaloids, saponin, diterpenes, tannins, cardiac glycosides, flavonoids, steroids, , carbohydrates, phenols and absence of tarpinoid and triterpenoid. ^[11]
Beena Rawat et al, 2021	The FTIR spectroscopic analysis of crude extract of Cucurbita pepo seeds Cucurbita pepo seeds showed the presence of alkaloids, flavonoids, phenols, saponins and terpenoids. The spectroscopic analysis showed the peaks at 293, 312, 299, 283, 357 nm with the absorption 0.966, 1.012, 0.866, 0.954, 0.854 respectively. These absorption bands are characteristic for phytochemicals like alkaloids, flavonoids, phenols, saponins and terpenoids. ^[12]
Dieu-Hien Truong et al, 2019	UV-Vis spectrophotometer, High-Performance Liquid Chromatography analysis of Severinia buxifolia plant extract showed presence of phenol (13.36 mg GAE/g DW), flavonoid (1.92 mg QE/g DW), alkaloid (1.40 mg AE/g DW), and terpenoids (1.25%, w/w). ^[13]
Thitima Rukachaisiriku et al, 2016	The spectroscopic analysis of Rauwolfia serpentina showed presence of twenty alkaloids 21-O-methylisoajmaline, reserpine, tetrahydroalstonine, reserpine, venoterpine, yohimbine, 6'-O-(3,4,5-trimethoxybenzoyl) glomeratose A, isoajmaline, Dglucopyranoside, rescidine, 7-deoxyloganin acid, ajmaline, suaveoline, (+)-tetraphyllicine, loganic acid, 3-hydroxysarpagine β -D-glucopyranoside and stigmasterol 3-O- β -sitosterol 3-O- β -yohimbine, methyl 3,4,5-trimethoxy-trans-cinnamate, a mixture of α 3-epi- and sarpagine were isolated from the roots of Rauwolfia serpentina. ^[14]

Long Fan et al, 2016	Total alkaloids and individual alkaloid (berberine) contents in roots and stems from five origins of <i>Berberis</i> plants were tested by Acid dye colorimetry and High-Performance Liquid Chromatography. The results showed that the contents for the total alkaloids in root and stem samples were in the range of 1.60–4.72% and 0.76–2.70%, while those of the berberine were 0.70–2.92% and 0.23–1.07%. With higher contents of the total alkaloids and berberine, the roots of <i>B. soulieana</i> , <i>B. gagnepainii</i> and <i>B. bergmanniae</i> were good sources of a traditional Chinese medicine Sankezhen. ^[15]
Hawraz Jawdat Jafaar et al, 2021	<i>Papaver glaucum</i> and <i>Papaver decaisnei</i> were evaluated for alkaloid content. Two alkaloids, proaporphine-type mecambrine and aporphine-type roemerine were isolated from <i>Papaver decaisnei</i> . Two benzyloquinoline alkaloids papaverine and palaudine as well as aporphine-type N-methylasimilobine have been obtained in <i>Papaver glaucum</i> . ^[16]
Shazia Tabasum et al, 2016	The hydro-methanolic seed extract of <i>Abrus precatorius</i> L were 219.966±4.714 mg gallic acid equivalent per gram in total phenolic content, 73.333±2.357 rutin equivalent per gram in total flavonoids content, and 41.666±4.784 atropine equivalent per gram in total alkaloid content. ^[17]
Manjunath Ajanal et al, 2012	Chitrakadivati consist of 16 ingredients. Chitrakadivati extract was tested by Dragendorff's method. Out of 16 ingredients, 9 contain alkaloid. UV-Spectrophotometer analysis shows 0.16% of total alkaloids in Chitrakadivati. ^[18]
E Fachriyah et al, 2018	Ethanol extract of <i>Peperomia pellucida</i> gave a positive reaction of alkaloids to Mayer and Dragendorff reagents. Most of the alkaloids found in the Piperaceae family are piperidine. Nigramide L (λ_{max} 209 nm), Nigramide N (λ_{max} 208 nm) and Nigramide N (λ_{max} 206 nm) were identified by UV-Vis spectrophotometer. ^[19]

RESULT AND DISCUSSION

On comprehensive evaluation of these articles application of Mayer's test to determine alkaloids in various drugs for qualitative analysis and UV-vis spectrophotometer for quantitative work with comparative analysis. Alkaloid absorption of any substance is reckoned through various techniques like UV-vis spectrophotometer, High-performance liquid chromatography, thin layer chromatography, Fourier Transform Infrared Spectroscopy, Gas chromatography-mass spectroscopy, Atomic absorption spectrophotometer etc. review was done by assessment of articles collected in between 2012 to 2022 from numerous databases like Google scholar and PubMed. As conclusion Mayer's test and UV-vis spectroscopy is one of the familiar techniques which used to detect alkaloid content and its absorbance in any drug substance. Alkaloids make up approximately 20% of the known secondary metabolites founds in plants. In plants, alkaloids protect plants from predators and regulate their growth. Well-known alkaloids used in clinical settings include morphine, strychnine, quinine, ephedrine, and nicotine. Recently, there is a resurgence of interest in bioactive natural products, driven both by a very proactive development in the field of traditional medicines as well as their potential in drug discovery.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

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